use criteria were categorized as uncertain for coronary revascularization because of the equipoise of scientific evidence. Whereas we did not find significant differences in the adjusted rates of clinical outcomes among patients with uncertain indications, the hazard ratio was 0.61 (95% confidence interval: 0.28 to 1.16), suggesting a possible benefit of coronary revascularization. We believe there is an urgent need to understand factors associated with underutilization and overutilization of coronary revascularization. We also completely agree that larger, more comprehensive studies of patients in the uncertain category should be undertaken in the future to more definitively assess whether these types of patients derive benefit from coronary revascularization procedures.

***Dennis T. Ko, MD, MSc**
Harindra C. Wijeysundera, MD, PhD
Kori Kingsbury, MSN
Jack V. Tu, MD, PhD
for the Cardiac Care Network (CCN) of Ontario Variations in Revascularization Practice in Ontario (VRPO) Working Group

*Institute for Clinical Evaluative Sciences (ICES)
G106-2075 Bayview Avenue
Toronto, Ontario M4N 3M5
Canada
E-mail: dennis.ko@ices.on.ca

http://dx.doi.org/10.1016/j.jacc.2013.01.078

REFERENCES

1. Ko DT, Guo H, Wijeysundera HC, et al., for the Cardiac Care Network (CCN) of Ontario Variations in Revascularization Practice in Ontario (VRPO) Working Group. Assessing the association of appropriateness of coronary revascularization and clinical outcomes for patients with stable coronary artery disease. J Am Coll Cardiol 2012; 60:1876–84.
2. Patel MR, Dehmer GJ, Hirshfeld JW, et al. ACCF/SCAI/STS/AATS/AHA/ASNC 2009 appropriateness criteria for coronary revascularization: a report by the American College of Cardiology Foundation Appropriateness Criteria Task Force, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association for Thoracic Surgery, American Heart Association, and the American Society of Nuclear Cardiology. J Am Coll Cardiol 2009;53:530–53.

Reply

Continued debate and discussion of concerns around the appropriate use criteria (AUC) for revascularization such as those expressed by Drs. Kereiakes and Stone are essential in continuing to improve the process and application of the criteria (1). However, the concerns expressed and perspectives should be examined in light of the existing data with the AUC for revascularization.

With regards to the general limitations noted, several of the lines of data and perspectives may provide the view that the AUC glass is indeed "three-quarters full" rather than "mostly empty" as implied by the authors. Specifically, 1) the AUC do not represent a limited set of stakeholders, rather they involve representation from all of the cardiovascular professional societies and several reviewing organizations, and they represent the only existing criteria or recommendations that have been surveyed and found to have over 80% agreement with interventional cardiologists who have not gone through the evidence or review process (2). 2) Rather than "classifying a minority" patient scenario, the AUC in their current form have been shown to categorize in the NCDR (National Cardiovascular Data Registry) review by Chan et al. (3) (over 80%) and in the Ko et al. (4) paper in the *Journal* (over 85%) percutaneous coronary interventions or angiograms with significant stenosis. 3) The AUC do incorporate published lesion characteristics such as chronic occlusions, fractional flow reserve in the diagnostic catheterization criteria, and the extent of ischemia and lesion location as clinical correlates for myocardium supplied. Finally, 4) the AUC are based on published literature for effectiveness of revascularization and not on NCDR data; rather, the NCDR is being used to provide feedback to sites, where the limitations of site-entered data are highlighted by the authors.

Drs. Kereiakes and Stone also have a misunderstanding of the AUC, in that the goal of the AUC is to ensure the appropriate use of revascularization aimed at improving patient health status and clinical outcomes, reducing both underuse and overuse. Notably, no practice document such as the AUC or clinical practice guidelines can capture the varied array of potential patient preferences; rather, these documents endeavor to provide the available evidence. Just as an asymptomatic patient with low-risk ischemia and 1-vessel obstructive coronary disease may initially prefer a percutaneous coronary intervention procedure based on pre-existing knowledge or conceptions, another patient with critical widespread 3-vessel coronary disease may prefer not to undergo revascularization based on exactly opposite pre-existing knowledge or conceptions. As such, the AUC are aimed at providing the clinician and patient the best available data and clinical consensus on revascularization care (based on symptoms/syndrome, anatomy, degree of ischemia, and medical therapy) so that a discussion to inform, educate, and then elicit patient preferences may be had. These decisions and practice patterns are then aggregated into population-based reports to centers to ensure they are consistent in who is offered revascularization.

Finally, the Drs. Kereiakes and Stone assert that the AUC are aimed more at overuse than underuse. Reviewing the ratings data for the 180 clinical scenarios demonstrate that the majority of the criteria is rated as appropriate, with a minority being rated as inappropriate with the existing published literature demonstrating low rates (<15%) of elective percutaneous coronary interventions with this categorization from multiple data sources. As stated, the AUC goal is to emphasize neither underuse nor overuse, but rather appropriate use. In this regard, Drs. Kereiakes and Stone are correct that evaluation of event rates from the uncertain group in the study by Ko et al. (4) demonstrates that 23 (15.3%) patients who did not undergo revascularization had died or had recurrent acute coronary syndromes at 3 years compared with 14 (8%) who underwent revascularization, potentially representing underuse in an underpowered observation. However, as a matter of perspective, readers should also note in the inappropriate categorized patients who did not undergo revascularization, 16 (9.4%) died or had recurrent acute coronary syndromes at 3 years compared with 20 (14.2%) who did undergo revascularization, almost the exact same numerical finding in the opposite direction of the uncertain group, potentially demonstrating overuse with harm in an underpowered observation. Hence, the report by Ko et al. (4) does provide

impetus for larger studies to better define areas both of underuse and overuse, but more importantly these data add to the growing data suggesting a gradient of clinical events across the rating categories.

***Manesh R. Patel, MD**

*Duke Heart Center, Duke Clinical Research Institute
Duke University
Durham, North Carolina 27710
E-mail: manesh.patel@duke.edu

http://dx.doi.org/10.1016/j.jacc.2013.01.075

REFERENCES

1. Patel MR. Appropriate use criteria to reduce underuse and overuse: striking the right balance. J Am Coll Cardiol 2012;60:1885–7.
2. Chan PS, Brindis RG, Cohen DJ, et al. Concordance of physician ratings with the appropriate use criteria for coronary revascularization. J Am Coll Cardiol 2011;57:1546–53.
3. Chan PS, Patel MR, Klein LW, et al. Appropriateness of percutaneous coronary intervention. JAMA 2011;306:53–61.
4. Ko DT, Guo H, Wijeysundera HC, et al., for the Cardiac Care Network (CCN) of Ontario Variations in Revascularization Practice in Ontario (VRPO) Working Group. Assessing the association of appropriateness of coronary revascularization and clinical outcomes for patients with stable coronary artery disease. J Am Coll Cardiol 2012; 60:1876–84.